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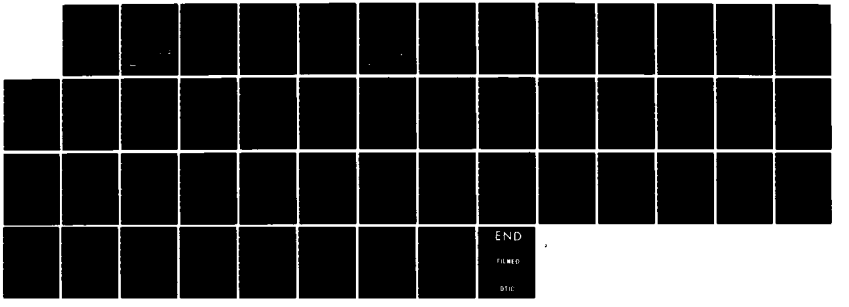

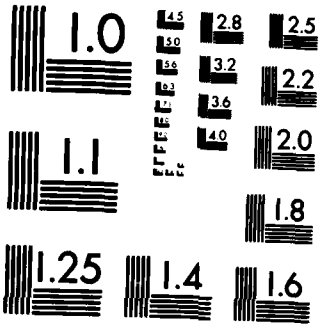

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A RAND NOTE

AD-A150 151

EXPORT SUBSIDIES AS INSTRUMENTS OF ECONOMIC AND FOREIGN POLICY

Stephen W. Salant

June 1984

N-2120-USDP

Prepared for

The Office of the Under Secretary of Defense for Policy

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The use of direct and indirect subsidies to promote exports is a popular instrument of trade policy in many countries. Of particular concern in this study is the use of such subsidies to promote Western exports to the Soviet Union and its allies. It investigates some of the arguments that could be used to justify such subsidies either because they improve the economic welfare of the exporting countries or because they promote behavior by the Soviet Union that is more compatible with the goals of the West. The study concludes that, on balance, there is no strong justification for export subsidies on economic grounds, but that it is possible to adopt a two-tier tax/subsidy system that may produce foreign policy benefits that outweigh the economic effects.

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A RAND NOTE

EXPORT SUBSIDIES AS INSTRUMENTS OF ECONOMIC AND FOREIGN POLICY

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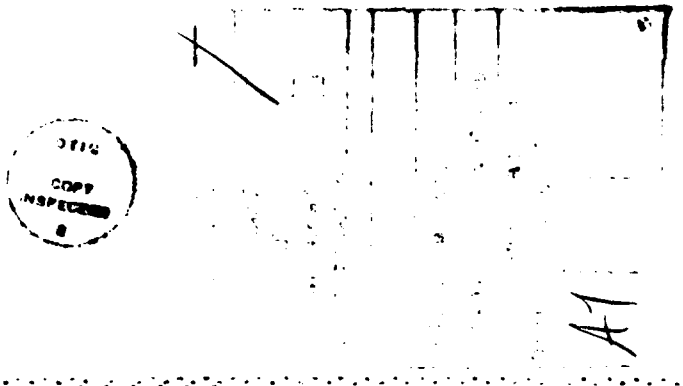
PREFACE

This Note is one in a series prepared for the Office of the Under Secretary for Defense for Policy. As a product of Rand's research program on international economic policy, it should be of interest to policymakers concerned with international resource flows. The Note addresses some of the arguments used to justify the subsidization of exports on economic grounds. It also investigates the usefulness of trade policy as an instrument of East-West policy, and the extent to which the West, through trade policy, may directly or indirectly affect military spending and expansion in the Soviet Union.

Other Rand Publications within the same project include:

- *Subsidization of East-West Trade Through Credit Insurance and Loan Guarantees*, by Daniel F. Kohler and Kip T. Fisher, N-1951-USDP, January 1983.
- *The Effect of Subsidized Finance on the Volume and Composition of East-West Trade*, by Keith Crane and Daniel F. Kohler, N-2106-USDP, June 1984.
- *Incentives and Insurance in International Financial Markets*, by Daniel F. Kohler, N-2117-USDP, June 1984.
- *Economic Cost and Benefits of Subsidizing Western Credits to the East*, by Daniel F. Kohler, with Stephen W. Salant, Donald P. Henry, Keith W. Crane, and Mark M. Hopkins, R-3129-USDP, May 1984.

These reports should help to inform the current debate on international export competition and the problems of excessive debt burdens by some borrowing countries (or excessive lending by Western governments and banks).



SUMMARY

The use of direct and indirect subsidies to promote exports is a popular instrument of trade policy in many countries. Of particular concern in this study is the use of such subsidies to promote Western exports to the Soviet Union and its allies. Investigated here are some of the arguments that could be used to justify such subsidies either because they improve the economic welfare of the exporting countries or because they promote behavior by the Soviet Union that is more compatible with the goals of the West.

The economic arguments are divided into two categories: arguments that apply in situations where export industries are perfectly competitive and those that apply when they are less than perfectly competitive. When export industries are competitive, one finds that export subsidies may be justified if externalities exist that cannot be internalized by the firms themselves. This would be the case, for example, if the exporting firms, through exports, were to acquire knowledge and expertise that was beneficial to other firms in the economy, or if by promoting the sale of one product through subsidies, the demand for a complementary export good produced by a different firm could be substantially enhanced.

These sorts of externalities can justify export subsidies by the government only if they cannot be internalized by a single firm itself. For example, if a machine and its spare parts were produced by the same company, there would be no justification for subsidizing the export of one of these complementary goods. If such an action to stimulate sales of its product were economically beneficial, the exporting firm would undertake it even without government intervention.

The second set of economic arguments in favor of export subsidies is based on market imperfections. It has been argued, under particular assumptions, that if the industries of two countries exporting to a third are imperfectly competitive then it may be in the interest of either country to subsidize its exports, provided that the other country does also. This argument is examined and its robustness is shown to be limited.

But even when it is in each country's interest to subsidize its exports--given that other countries do--it would be in the interest of the West as a whole to avoid export subsidies. Indeed, the optimal trade policy is a tax.

If market power is assumed to reside with the importer (the Soviet Union) instead of export firms of a given country, one can show that export taxes, not subsidies, promote the economic interest of the exporting country. By applying a nonlinear tax/subsidy schedule to exports to the Soviet Union, the Western government can completely offset the Soviet's monopsony power and--indeed--can extract all of its consumer surplus.

On balance, there is no strong justification for export subsidies on economic grounds. However, trade policy also has foreign-policy consequences. Export taxes and subsidies could play an important role in East-West foreign policy. It is, for example, possible to adopt a two-tier tax/subsidy system that could provide the Soviet Union with a set of incentives designed to foster international behavior more acceptable to the West. This differentiated approach to trade policy as an instrument of foreign policy leads to a set of arguments in favor of government subsidies in foreign trade which may be more important than the economic arguments.

ACKNOWLEDGMENTS

I would like to acknowledge with gratitude the substantial contributions of two Rand colleagues, Jonathan Cave and Daniel Kohler. Jonathan contributed to the example of the "complements" case in Sec. II, while Dan made countless valuable suggestions throughout the manuscript to highlight the relevance of its analytical results for the current policy debate. I would also like to thank James Brander of the University of British Columbia for his careful review of an earlier draft of this Note.

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I. INTRODUCTION

Orthodox neoclassical economic theory holds that in the standard two-good competitive trade model it is never in the interest of a country as a whole to subsidize its exports. In this model, the optimal trade policy--if any is called for--is always a tariff, never a subsidy. Export subsidies might be in the interest of a particular industry, but any welfare gains to this industry are more than offset by welfare losses elsewhere in the economy.

Export subsidies abound in the international market today. Given the unequivocal conclusions of the two-sector trade model, one might infer that every Western government is a captive of special interest groups. Although a distinct possibility, such an inference would be premature. For, there do exist circumstances--assumed away in the standard model--that would make export subsidies in the general interest of the exporting country. This Note examines the circumstances that might justify export subsidies on economic or foreign policy grounds.

TYPES OF EXPORT SUBSIDIES

Before analyzing these circumstances it is important to distinguish the different ways by which a country can subsidize its exports. Since export subsidies are theoretically proscribed by the General Agreement on Tariffs and Trades (GATT), exporting nations tend to be rather circumspect. Direct payments to either firm or buyer per unit transacted are rare. Indirect forms such as two-tier foreign exchange markets or preferential tax treatments are more common.

Credit insurance and guarantees, along with direct discounting of loans by the government, are the most widespread form of export subsidies. On exports from the Organization for Economic Cooperation and Development (OECD) to the communist bloc alone they may amount to $2 $3 billion a year (Kohler, 1984).

Export credit subsidies may be general or product-specific. The recent extension of a DM 1.5 billion untied credit by West Germany to East Germany is but one example of a general subsidy. The credit,

although extended by a consortium of West German banks, is guaranteed by the West German government; as a consequence, the finance charges are considerably below what East Germany would have to pay in the open market. The subsidy is general, because the loan is untied--i.e., East Germany is free to use it as it pleases.

More frequent are product- or even transaction-specific export credit subsidies. For example, in 1980 the Commodity Credit Corporation (CCC) of the U.S. Department of Agriculture guaranteed loans to Poland for the purpose of purchasing U.S. grain. Because of this guarantee, the credits carried interest rates very close to the London Interbank Offer Rate (LIBOR). The spread was typically around 3/8 of a percent at a time when the spread on uninsured loans to Poland was more than 2 percent. These subsidies were product-specific, because the CCC guarantee applied only to loans used for the purchase of grain.

It is the distinction between general and product-specific subsidies--rather than the form in which the subsidies are given--which is important. In making purchase decisions, an importer evaluates the cost of the product. A reduction in the financing costs, for example, lowers the future repayments necessary to pay off the debt and has the same effect as a reduction in the price of the product.[1] We can thus, without loss of generality, express any indirect product-specific subsidy as a direct reduction in the product price.

WHEN EXPORT SUBSIDIES PROMOTE THE GENERAL INTEREST--THE ECONOMIC ARGUMENTS

At the outset, it is useful to review the traditional argument *against* subsidizing the export of a product. An export subsidy of a given amount per unit transacted will raise the domestic price of a product--stimulating home production and curbing home consumption.[2] As a consequence, exports--the excess of home production over home

---

[1]We are implicitly making the "small-country" assumption here that the real rate of interest is set in world markets and is unaffected by credit subsidies of the particular exporting country.

[2]It is assumed that domestic consumers are prevented by their government from purchasing at the lower prices prevailing in the world market.

consumption--will increase. The world market price of the commodity may have to fall slightly to accommodate this increased supply.

Since the export subsidy raises the domestic price of the exported good, domestic residents who consume it are worse off and those who produce it (the special interests) are better off. Taxpayers are, of course, worse off, for they must pay for the subsidy.

These gains and losses do not merely cancel out, however. In the two-good case with competition on both sides of the market and no externalities, it is easy to show that the losses of the consumers and taxpayers must *exceed* the gains of the producers. In Fig. 1, the demand for the good by home consumers and the supply of the good by home producers is displayed. Prior to the subsidy the domestic price is P_0; afterward, the price rises to P_1. The loss suffered by consumers as a result of the price increase is represented by the areas of rectangle a plus triangle b.[3] The gain of producers as a result of the price increase is represented by area (a+b+c). The loss sustained by taxpayers is at least as great as area (b+c+d); if the subsidy lowers the world price, area (b+c+d) understates the cost to taxpayers. Hence the losses exceed the gains by at least area (b+d). The export subsidy, therefore, does not merely redistribute surplus from some citizens to others; it renders some surplus *unavailable to anyone*. Therefore the policy is said to injure the general interest.

This argument against export subsidies is based implicitly on the assumption that externalities are absent and that neither buyers nor sellers have appreciable market power. In addition, the argument is demonstrated in a two-good model, thus precluding the possibility that importers would regard two or more goods as complements.

In the presence of either pecuniary or nonpecuniary externalities among firms, however, export subsidies can be beneficial even when buyers and sellers lack market power. If the costs of one export firm are lowered because of the experience in production of another export firm, for example, this nonpecuniary externality might make subsidization of the first firm in the general interest. In terms of Fig. 1, the supply curve no longer reflects marginal social costs, and

[3]Readers wishing further discussion of such geometric welfare analysis should consult Layard and Walters (1978).

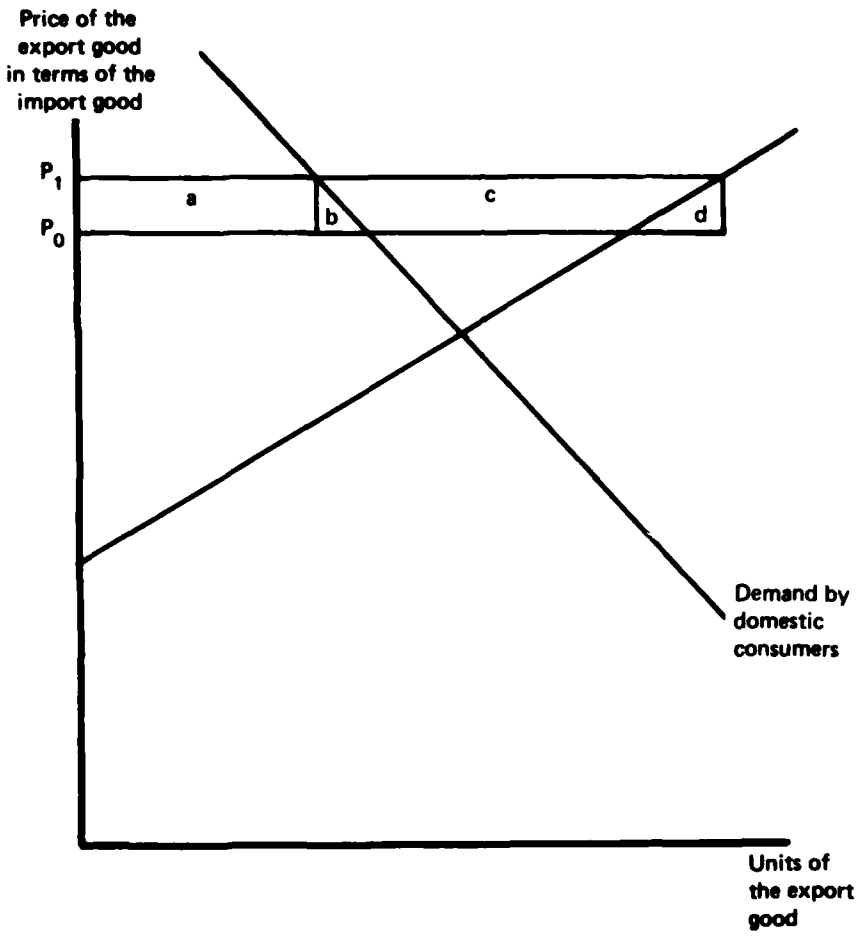

Fig. 1 — Illustration of the traditional argument against export subsidies

area (a+b+c) understates the actual gain to producers induced by the export subsidy. If reductions in the price of one kind of exported good increase the demand for the exports of a complementary good produced by a different firm, this pecuniary externality might make subsidization of firms producing the first good in the general interest. Figure 1 cannot even address this case because it involves not only the import and export goods referred to in that diagram, but also a second export good. Both of these arguments will be considered in Sec. II.

When either buyers or sellers have market power, the traditional argument against export subsidies must be re-examined. Recently, Brander and Spencer [1984] have shown that governments have an incentive to subsidize their exporting firms--even in a two-good world with no externalities--provided that the sellers are imperfectly competitive. In Sec. III my analysis of their arguments leads me to question the robustness of their results.

In the case of U.S. firms exporting to the Soviet bloc, market power is more likely to reside with the buyer than with the sellers. Section III concludes, therefore, by asking whether subsidies promote the economic interest of the exporting country as a whole when the buyer is a monopsonist. It is shown that a tariff--not a subsidy-- promotes the economic interest of the exporting country in such cases.

To summarize, the theoretical case in favor of export subsidies in the presence of market power on the seller side of the market seems extremely weak, and on the buyer side is nonexistent. Moreover, although the positive externality defense is logically unassailable, its applicability to many of the situations where subsidies have been granted seems questionable.

FOREIGN POLICY EFFECTS OF EXPORT SUBSIDIES

Before concluding that such subsidies injure the welfare of the exporting country, however, foreign policy consequences also deserve consideration. In trade with the Third World, subsidized export finance is often justified as a form of foreign aid. Even though this form of aid is less efficient than direct transfers, it may serve the foreign policy interests of the United States.

In trade with the Soviet Union, political arguments in favor of subsidizing exports are more difficult to imagine. After all, such subsidies have "income effects." They may well induce the Soviets to increase their military expenditures. On the other hand, export subsidies, especially if they are product-specific, also have "substitution effects". The *sum* of these two kinds of effects determines the net behavioral response of the Soviets.

It is rational to judge export subsidies--like any instrument with consequences for foreign policy--by whether the behavior they induce promotes the interests of the United States. Occasions may arise in which product-specific export subsidies can be used to promote Soviet behavior that is in the foreign policy interest of the United States. When the substitution effects induced by a subsidy would be beneficial but the income effects would be harmful, a more sophisticated policy can be fashioned which neutralizes (or reverses) the income effects while preserving the benefits of the substitution effects. This approach is illustrated in Sec. IV, where I suggest ways in which Western governments might use export taxes and subsidies as sophisticated instruments for checking Soviet military buildup and expansion.

II. EXPORT SUBSIDIES WHEN FIRMS ARE PERFECTLY COMPETITIVE

INTERFIRM LEARNING

Suppose that U.S. firms are perfectly competitive and export a homogeneous good in exchange for some other good. In the absence of externalities, no export subsidy would be called for. But in some cases, the production costs of the rest of the firms will be lowered in the future because pioneer firms previously gained experience producing and exporting the good. In such cases, the market would not compensate pioneer firms fully for the benefits their production bestows on other firms, and the competitive solution is inefficient. A subsidy on the exports of the pioneer firms will expand their production and lower the costs to other firms in the market. The subsidy should be set to equal the marginal social benefit bestowed on the other firms.[1]

It is difficult to determine whether this argument would justify a large proportion of U.S. export subsidies. A review of the lending activities of the Export-Import Bank (EXIM Bank) in a typical year (1980) indicataes that industries where learning effects might be anticipated do not receive a disproportionate share of export subsidies (Table 1). As is apparent, traditional heavy-equipment-type industries are the primary beneficiaries of export subsidies. Agriculture, through the CCC, is also a major recipient of export support that cannot be justified by an interfirm learning argument.

COMPLEMENTS IN CONSUMPTION

In the absence of such nonpecuriary externalities, a subsidy is never optimal in a *two-good* competitive model. Although this stylized model is the one most familiar to the economics profession, it is obviously unrealistic. In fact, however, export subsidies *may be optimal* even with competition and no externalities as long as *three or more* goods are traded.

---

[1]While such interfirm learning would justify an export subsidy, a production subsidy (properly set) would be preferable both to an export subsidy and to the free-market outcome. A similar point is exposited in Layard and Walters, p. 107.

TABLE 1
DISTRIBUTION OF FY 1980 EXIM BANK LENDING

Thousands of dollars
(Percent)

Item	REGION OF DESTINATION							TOTAL: AS % OF U.S. EXPORTS
	EASTERN EUROPE	O.E.C.D.	LATIN AMERICA	AFRICA	ASIA	MIDDLE EAST	TOTAL	
TRANSPORT EQUIPMENT	21,629 (17.51)	1,158,968 (85.33)	153,373 (25.95)	77,526 (25.42)	64,837 (5.88)	282,424 (46.58)	1,758,757 (43.03)	6.43
POWER PRODUCTION DISTRIBUTION	22,500 (18.22)	111,323 (8.20)	178,928 (30.27)	150,025 (49.19)	592,385 (53.71)	271,160 (44.72)	1,326,321 (32.45)	40.76
COMPUTER EQUIPMENT	0 (0.00)	0 (0.00)	12,750 (2.16)	0 (0.00)	0 (0.00)	0 (0.00)	12,750 (0.31)	0.16
TELECOMMUNICATION EQUIPMENT	3,972 (3.22)	0 (0.00)	0 (0.00)	7,735 (2.54)	295,040 (26.75)	7,759 (1.28)	314,506 (7.70)	9.11
OTHER PLANT & EQUIPMENT	13,822 (11.19)	71,957 (5.30)	221,791 (37.52)	25,485 (8.36)	145,435 (13.19)	26,518 (4.37)	505,008 (12.36)	1.18
BUSINESS SERVICES	55,100 (44.62)	4,840 (0.36)	0 (0.00)	0 (0.00)	2,976 (0.27)	11,375 (1.88)	74,291 (1.82)	-
CFF LOANS	3,571 (2.89)	6,208 (0.46)	22,741 (3.85)	0 (0.00)	2,247 (0.20)	6,167 (1.02)	40,934 (1.00)	-
CAPITALIZED INTEREST	2,906 (2.35)	4,930 (0.36)	1,491 (0.25)	44,204 (14.49)	0 (0.00)	924 (0.15)	54,455 (1.33)	-
TOTAL	123,500 (100.00)	1,358,226 (100.00)	591,074 (100.00)	304,975 (100.00)	1,102,920 (100.00)	606,327 (100.00)	4,087,022 (100.00)	-

Source: Statistical Abstract of the United States, 1981 (calendar year 1980 data). Commitments made during FY 1980; disbursements take place with variable delays after commitments. Includes loans to foreign banks.
The Cooperative Financing Facility (CFF) provides lines of credit to foreign banks for the purpose of financing up to 50 percent of individual U.S. export transactions.

For simplicity, consider the three-good case. Suppose that the United States exports two goods and imports a third good in exchange. Suppose that the two export goods are complements in demand; that is, if the price of either good falls, demand for *each* good increases.

Denote the two export goods by x and y and the import good by b. Suppose that the supply of x in the United States is perfectly elastic but that the supply of y is constrained and hence perfectly inelastic. A subsidy on x in this case may be in the U.S. interest. It will lower the price of x paid by competitive consumers (P_x) by the amount of the subsidy but will cause the demand curve for y to shift outward, and will therefore result in a higher price (P_y) paid by price-taking consumers of y. The following example suffices to show that an export subsidy may be optimal in the three-good competitive case.

Suppose that the representative importer's preferences can be represented by $U = \ln(\min(x, y^2)) + b$. If he chooses the best consumption bundle (x, y, b) available given M (his endowment of good b) then he must set $x = y^2$ since the two goods are complements. Hence the optimal choice

(1) maximizes $\ln y^2 + b$ subject to $P_y y + P_x y^2 + b = M$,
$x,y,b \geq 0$

where b is the "numeraire good."

Substituting for b from the constraint, we conclude that the optimal choice

maximizes $\ln(y^2) + [M - P_y y - P_x y^2]$.
$y \geq 0$

Hence the optimal consumption bundle is defined implicitly as follows:

(2) $\frac{2}{y} - P_y - 2yP_x = 0$

(3) $x = y^2$

(4) $b = M - P_y y - P_x y^2$.

If x is supplied elastically at per-unit cost c_x but no more than y units of the other good can be supplied (each at per-unit cost c_y), then a subsidy of s_x will induce the following values for the endogenous variables (P_x, P_y, x, and y):

$$(5) \quad P_x = c_x - s_x$$

$$P_y = \frac{2}{y} - 2yP_x$$

$$x = \bar{y}^2$$

$$y = \bar{y}.$$

The exporting government wishes to increase the sum of firm profits and treasury revenues:

$$(6) \quad \pi = \{(P_x - c_x)x + (P_y - c_y)y + s_x x\} - s_x x$$

$$= -s_x\bar{y}^2 - c_y\bar{y} + \bar{y}\left\{\frac{2}{\bar{y}} - 2\bar{y}\, c_x + 2\bar{y}\, s_x\right\}$$

Since $\frac{d\pi}{ds_x} = -\bar{y}^2 + 2\bar{y}^2 = \bar{y}^2 > 0$, *a* positive subsidy is desirable.

The intuition underlying this example is straightforward. A one-dollar subsidy on x will reduce the price of x by one dollar. In response, the importer would increase his demand for both goods x and y (its complement) unless the price of y were also to change. But production of y cannot increase, and the importer regards additional x as useless without additional y. Hence the price of y *must increase* enough to restore the importer's demands for both goods to their previous levels. From Eq. (2)

$$(7) \quad \left.\frac{dP_y}{dP_x}\right|_{x,y} = -2y.$$

That is, the one-dollar reduction in the price of x requires a 2y dollar increase in the price of y to leave demand for both goods unchanged. But then the subsidy lowers total revenues on x by (1)x and raises total

revenues on y by (2y)y. Since $x = y^2$, this net change in profits ($2y^2 - x = y^2$) is always positive. Hence the export subsidy is always beneficial.

The extreme assumptions underlying this example are intended to make the result transparent. However, it is easy to establish that net export subsidies may continue to be optimal in a three-good competitive world when the complementarity in demand is less extreme and when the industry supply curve for each good is upward-sloping.[2]

This justification for export subsidies has not escaped the attention of those who would benefit from them. Subsidies on equipment are advocated as a means to increase the demand for spare parts. Subsidies on computers are urged as a means of stimulating the demand for software. The list is endless. Subsidies are, of course, never warranted if the same firm produces both goods--since then the externality would be internalized without government intervention.[3] But even when the complement is produced by a different firm, there is a tendency to overstate the magnitude of the induced price increase by overlooking the supply responses of firms in *other* countries, which may produce the same complement. Hence, in our example, the price of y might not increase at all if exporters in other countries were not capacity-constrained like us. Analogous comments apply to the learning justification. No subsidy is, of course, warranted if the firm itself will be the only beneficiary of its experience. But even if a different U.S. firm would also benefit, there is every reason to expect that these interfirm benefits will spread across national boundaries. If they do, the reduced costs of the foreign firms may put U.S. firms at a competitive disadvantage.

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[2]A more general analysis of the complements case has been conducted independently by Robert Feenstra (1983).

[3]The argument that a firm which could reap scale economies should receive export subsidies suffers from the same fallacy. If such benefits were worthwhile, the firm itself would capture them even in the absence of government intervention.

III. EXPORT SUBSIDIES UNDER IMPERFECT COMPETITION

MARKET POWER ON THE FIRM SIDE

Recently, the conventional view that export subsidies are never optimal has been attacked from a different direction. In a forthcoming article, James Brander and Barbara Spencer show that countries have an incentive to subsidize their exporting firms even in a two-good world with no externalities provided that the market in the export good is imperfectly competitive. In their model, B-S assume that each of two countries contains a single firm exporting to a third country. B-S ignore trade between the two exporting countries.

Governments select export subsidies simultaneously. With knowledge of these subsidy levels, firms produce and sell output simultaneously. B-S show that positive export subsidies occur in equilibrium.

They go on to show that both exporting governments would prefer the situation where neither subsidized its exports. Indeed, to *maximize* their joint welfare, both countries should impose a tariff on exports. However, B-S show that in a one-shot game, a multilateral agreement to refrain from such subsidies would inevitably collapse since--given compliance by the other parties--any individual country has an incentive to pay subsidies unilaterally.

Their conclusions contradict the conventional wisdom that governments would never impose export subsidies unless they were captives of special interests. B-S therefore force us to ask: Under what circumstances will such subsidies be in the general interest of a country? According to B-S, their result is extremely robust:

> These assumptions can be relaxed without affecting the central principles under consideration. Introducing differentiated products, *more firms*, or non-Cournot conjectural variations does not alter the general properties of the model, although the analysis becomes much more algebra-intensive. . . . Assumptions which are essential to the analysis include the possibility of pure profits and the credibility of the government policy. [emphasis added]

They leave the impression that if *more than one* country exports to a given country and if markets are *imperfectly competitive*, then the equilibrium will always involve export subsidies for each country if each government pursues the general interest of its citizens. This impression is misleading as we will see below.[1]

The analysis that follows is unavoidably tedious. However, the setup is quite general, including as special cases the traditional two-good competitive model as well as Brander and Spencer's model, and others. Hence the return to investment in the algebra is substantial.

Assume that the United States and the United Kingdom each produce the same goods for export to the Soviet Union. Assume that there is no domestic demand for this product in either exporting country. Let n (resp. N) denote the number of U.S. (resp. U.K.) firms in the industry, and x (resp. y) denote the output of each firm. Denote the per-unit subsidy received by each U.S. (resp. U.K.) exporter as s (resp. S). Since the export good is assumed to be homogeneous, the buyer will purchase from whichever source is cheaper. Hence, in equilibrium the price charged by U.S. and U.K. firms will be identical. Let P denote this common price.

Given the exogenous variables (n, N, s, S), the following three equations determine the endogenous variables (x, y, P) of the model.

$$(8)\quad P(nx + Ny) - c'_x(x) + s + \alpha x P'(nx + Ny) = 0$$

$$(9)\quad P(nx + Ny) - c'_y(y) + S + \alpha y P'(nx + Ny) = 0$$

$$(10)\quad P = P(nx + Ny),$$

where α is an exogenous parameter set equal to either zero or one. Whenever we consider the case of perfect competition, we will set $\alpha=0$. Equations (8) and (9) then reduce to the familiar condition that, in each exporting country, price equals marginal cost less the subsidy.

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[1]For a somewhat related discussion arrived at independently, see Dixit (1984). Brander informs me that the forthcoming version of his article with Spencer will be modified in accord with these analyses to limit the claims about the generality of their results.

Whenever we consider the case of imperfect competition, we will set $\alpha=1$. Equations (8) and (9) then reduce to the conventional conditions that, in each exporting country, marginal revenue equals marginal cost less the subsidy.

Since there is assumed to be no domestic consumption, the objective of each government is to maximize the sum of the profits of its exporters and the revenues of its treasury. The objective of the United States, for example, is to maximize (s.t. $s \geq 0$)

$$(11)\quad \pi(x(s),y(s);\, n,N,\alpha) = n[xP(nx + Ny) - c_x(x) + xs] - nxs$$
$$= n[xP(nx + Ny) - c_x(x)].$$

An increase in the export subsidy will therefore have the following effect on the net payoff to the United States:

$$(12)\quad \frac{1}{n}\frac{d\pi}{ds} = P\frac{dx}{ds} + nxP'\frac{dx}{ds} + NxP'\frac{dy}{ds} - c_x'\frac{dx}{ds}$$

$$= \frac{dx}{ds}\{P + nxP' - c_x'\} + \frac{dy}{ds}\{NxP'\}$$

$$= \frac{dx}{ds}\{nxP' - s - \alpha xP'\} + \frac{dy}{ds}\{NxP'\}.$$

In the competitive case ($\alpha = 0$),

$$(13)\quad \frac{1}{n}\frac{d\pi}{ds} = \{n\frac{dx}{ds} + N\frac{dy}{ds}\}\, xP' - s\frac{dx}{ds} = x\frac{dP}{ds} - s\frac{dx}{ds}.$$

As we will prove below, a subsidy on U.S. exports always lowers the market price ($\frac{dP}{ds} < 0$), increases U.S. output ($\frac{dx}{ds} > 0$), and reduces U.K. output ($\frac{dy}{ds} < 0$). Hence, $\frac{d\pi}{ds} < 0$ in the competitive case and a subsidy is never optimal.

In the case of imperfect competition ($\alpha = 1$),

$$(14)\quad \frac{1}{n}\frac{d\pi}{ds} = \frac{dx}{ds}\{(n-1)xP' - s\} + \frac{dy}{ds}\{NxP'\}.$$

Hence, *provided* that the U.S. industry consists of a *single* firm, $\frac{d\pi}{ds}|_{s=0} > 0$-- regardless of the subsidy in the United Kingdom. No matter what level of subsidy the United Kingdom adopts, it will alway be optimal for the United States to provide a positive subsidy to its exporters. This is Brander and Spencer's recent finding.

Theirs is unquestionably a striking result. It implies that a monopolist taking over the U.S. economy (consisting here of the single export firm) and taking into account the *reactions* of the foreign competition, would direct the firm to *expand* production. But the relevance of this result to our multi-firm economy depends in large part on its sensitivity to the number of firms assumed to exist in each country.

Research in related areas suggests that the B-S result is not robust. It has been shown, for example, that under *laissez faire* a Cournot model of imperfect competition like theirs will converge to the conventional model of perfect competition as the number of firms in each exporting country is increased without bound. Since a subsidy is never optimal in the limiting case of competition, one suspects that their subsidy result will fail as the number of firms assumed to exist in each country is increased.

A recent paper by Salant, Switzer, and Reynolds (*QJE*, 1983) buttresses this view and suggests that the B-S result is unlikely to hold as the number of U.S. firms is increased (holding constant the number of U.K. firms). A horizontal merger of all of the U.S. firms would cause the output of each to *contract* and the output of the U.K. firms (all of which are outside the merger) to expand. S-S-R show that if the number of firms inside the merger is small relative to the number of firms outside the merger, then the merger will be unprofitable; otherwise, it will be profitable. Whenever a merger of all U.S. export firms is profitable it seems likely that an export subsidy--which causes an *expansion* of the outputs of these same firms--would be unprofitable. B-S establish their results for n=1 and N=1. To confirm that their result is sensitive to the number of firms in each country, we therefore continue to assume N=1 but expand the number of export firms assumed to operate in the United States. We discover that a U.S. subsidy is *never* warranted in such circumstances for <u>any</u> U.K. subsidy and <u>any</u> $n = 2, 3...$

Consider the case where N = 1 but n = 2,3... As before,

$$(15)\quad \frac{1}{n}\frac{d\pi}{ds} = \frac{dx}{ds}\{(n-1)xP' - s\} + \frac{dy}{ds}\{NxP'\}.$$

Differentiating the model (8) - (9) we obtain:

$$(16)\quad \begin{pmatrix} nP' - c_x'' + \alpha P' + \alpha xP''n & NP' + N\alpha xP'' \\ nP' + n\alpha yP'' & NP' - c_y'' + \alpha P' + \alpha yP''N) \end{pmatrix} \begin{pmatrix} dx \\ dy \end{pmatrix} = - \begin{pmatrix} ds \\ ds \end{pmatrix}.$$

Using Cramer's rule, $\frac{dx}{ds} = \frac{-(\alpha+N)P' + y - N\alpha yP''}{\Delta}$

and $\frac{dx}{ds} = \frac{nP' + \alpha ynP''}{\Delta}$

where $\Delta = \begin{vmatrix} (n+\alpha)P' - c_x'' + \alpha xnP'' & N(P' + \alpha xP'') \\ nP' + \alpha ynP'' & (\alpha+N)P' - c_y'' + N\alpha yP'' \end{vmatrix}$.

B-S assume:

$$(17)\quad 2P' + yP'' - c_y'' < 0 \quad \text{(their equation 3*)}$$
$$(18)\quad P' + yP'' < 0 \quad \text{(their equation 4).}$$

Consequently, under perfect competition ($\alpha = 0$) or under imperfect competition with one U.K. firm ($N = 1$, $\alpha = 1$),

$$(19)\quad \Delta > 0,\ \frac{dx}{ds} > 0,\ \text{and}\ \frac{dy}{ds} < 0.$$

Indeed in this case,

$$(20)\quad \frac{1}{n}\frac{d\pi}{ds}\Big|_{s=0} = \frac{xP'}{\Delta}\{yP'' + (n-1)c_y'' - (n-2)P'\} - s\frac{dx}{ds}.$$

For $n = 1$, $\frac{d\pi}{ds}\Big|_{s=0} = \frac{xP'}{\Delta} yP'' + P' > 0$, the Brander-Spencer result.

But for $n \geq 2$, $c_y'' > 0$ and $P_y'' > 0$ is sufficient for $\frac{d\pi}{ds} < 0$ for any (s,S) pair.

In the cases we have examined, it is not in the general economic interest of the United States to subsidize its exports, even if other countries subsidize theirs and firms in the two countries are imperfectly competitive. A similar result would obtain (even for N>1) if the foreign exporters were capacity-constrained and earned rents; for they would then have no incentive to cut output in response to our subsidy. In short, the Brander-Spencer result is not as general as they suggest.[2]

In concluding this discussion, it is important to recall that even when export subsidies are the result of the competitive pressures among governments considered by B-S, it is always in the *collective* interest of the exporting countries to remove all such subsidies. This suggests the value of designing a self-enforcing multilateral agreement among the exporters to refrain from the imposition of export subsidies.[3]

MARKET POWER ON THE BUYER SIDE

In the past, Soviet government officials who negotiate import contracts have demonstrated their ability to use their market power and to play the different exporters and their respective governments off against each other. Stories abound about the informed conduct of Soviet negotiators awarding the contracts for the Yamal pipeline. In a recent *Wall Street Journal* editorial, Gordon Crovitz states:

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[2]It is hoped that in the future the relation between the trade and merger cases can be established more formally and that results from the merger literature can then be translated into findings about the desirability of export subsidies under imperfect competition.

[3]For a discussion of the impossibility of enforcing multilateral agreements externally, and of techniques for designing agreements that are in no one's interest to break unilaterally, see Salant (1984).

> The Soviet Union was a monopsonist, the sole 'buyer' of pipe and equipment from Europe.... All the information was held by the Soviets, who--at least in theory--should have been able to hold out for the best deal from each of the European countries. This is precisely what they did.... Western exporters of equipment were forced to cut their prices by as much as 60% because of their weak position as independent bargainers against the U.S.S.R.[4]

Such anecdotal evidence, while consistent with monopsonist behavior, does not constitute proof. The purchase by the Soviet Union of the identical goods in different markets at distinct prices would constitute unambiguous evidence of monopsony power. For the only reason a buyer would purchase anything at the higher price is to avoid bidding up the lower price in the other markets, thus increasing his total costs. Given the political sensitivities and the secrecy that surround international transactions like the pipeline deal, such evidence may be difficult to obtain.

The problem of how the Western governments should deal with a monopsonistic Soviet Union is difficult to analyze because of the divergent incentives faced by the different exporters and their respective governments. As a first step I confine my attention to how one government could use its power to tax and subsidize exports to offset the monopsony power of its trading partner. At this stage I ignore the different reactions from possible competitors in other countries and from their governments.[5]

Consider a competitive firm that produces an export good at strictly increasing marginal cost and sells it to a single importer, the Soviet Union. Figure 2 illustrates the situation in which the competitive firm finds itself prior to government intervention. If the buyer lacked market power, the export volume would be x_c and the price paid by the importer to the firm would be p_c. In that case, firms in the exporting country would earn profits of $p_c x_c - c(x_c)$ and the consumer in the

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[4]Gordon Crovitz, "Europe Pays for Its Pipe Dream," *The Wall Street Journal*, December 13, 1983.

[5]The generalization of this analysis and the design of self-enforcing cooperative agreements with Western partners on this issue are important topics that might be addressed in a follow-on project.

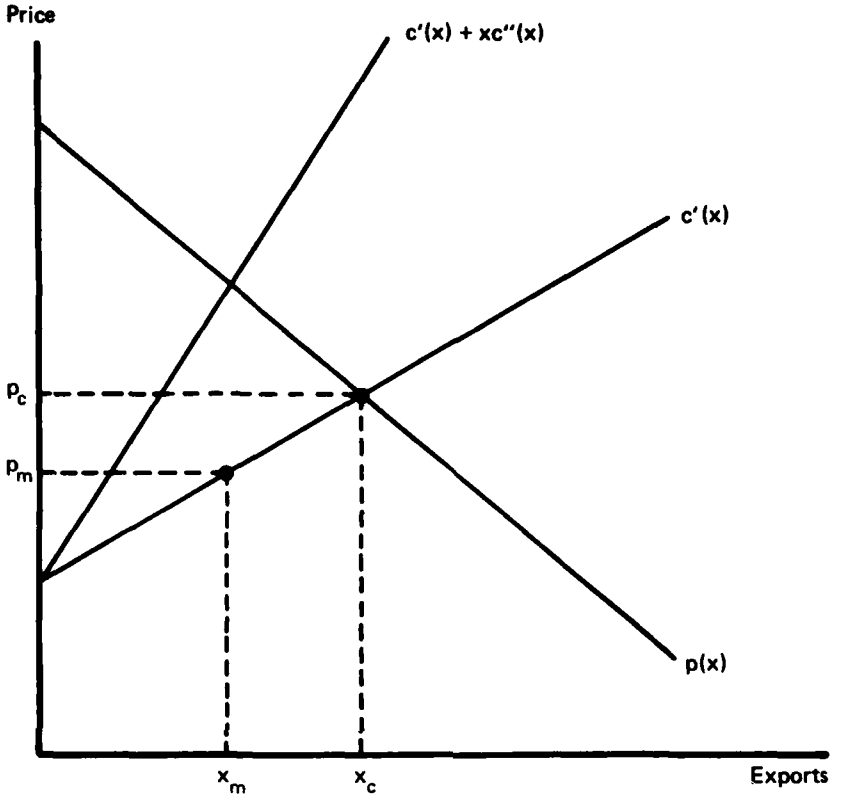

Fig. 2 – Competitive and monopsony equilibrium prior to imposition of tax/subsidy schedule

importing country would enjoy a consumer surplus of $\int_0^{x_c} p(u)du - p_c x_c$, where p(u) is the inverse demand curve.

The buyer could increase his surplus, however, if he exerted his monopsony power. For he would then realize that a one-unit increase in imports would raise his import bill by *more* than the price of that unit since it would bid up the price that must be paid on the inframarginal units. Accordingly, the monopsonist would import only $x_m (< x_c)$ units and would pay the lower price, $p_m (< p_c)$. More formally, the monopsonist would

$$(21) \quad \text{maximize} \quad \int_0^{x_m} p(u)du - px_m$$
$$x_m \geq 0$$
$$\text{subject to } p = c'(x_m).$$

Hence, $p(x_m) = c'(x_m) + x_m c''(x_m)$

and $p_m = c'(x_m)$.

Since the competitive level of imports is feasible but not chosen by the monopsonist, his consumer surplus must be larger in the monopsony equilibrium. Moreover, since the profits of the exporting firm rise with price, profits must be lower in the monopsony equilibrium.

Suppose that the government of the exporter sought to rectify this situation. One approach would be to offer to pay the exporter s(x) per unit sold to the monopsonist. If s(x) is positive (resp. negative), the exporter is subsidized (resp. taxed). However, s(x) is not like a conventional per unit tax, because it need not be a constant independent of the volume sold. Hence, s(x) encompasses any tax/subsidy schedule including the per unit and ad valorem types.

We begin by noting how the imposition of the policy will affect the supply response of the competitive firm. Given price p and tax/subsidy, schedule s(x), a firm with cost function c(x) ($c'>0$, $c''>0$) will

$$(22) \quad \text{maximize} \quad \pi(x) = px + xs(x) - c(x).$$
$$x \geq 0$$

If production is positive at the optimum

$$(23)\quad \pi'(x) = p + s(x) + xs'(x) - c'(x) = 0.$$

We now illustrate how the government of the exporting country can select a subsidy schedule that completely neutralizes the buyer's monopsony power and induces him to pay the competitive price (p_c) for the competitive volume of exports (x_c).

Suppose, for example, that the marginal cost curve is linear:

$$(24)\quad c'(x) = a + bx \quad \text{with } a, b > 0.$$

Suppose that the government wants to alter the competitive supply curve to make it perfectly elastic at price k (>a). For simplicity, let us see if this can be achieved with a linear subsidy schedule:

$$(25)\quad s(x) = d + ex.$$

By setting $s(x) = (a-k) + 1/2\ bx$, the government of the exporting country can induce a perfectly elastic response.

Proof: Recall from Eq. (23) that

$\pi'(x) = p + s(x) + xs'(x) - c'(x) = 0$
defines the competitive output at price p.
Substituting from Eqs. (24) and (25),
$\pi'(x) = p + (a-k) + bx - a - bx = p-k.$
Hence, the firm will produce nothing if p<k, infinite if p>k, and any amount demanded if p = k.
Hence supply is perfectly elastic at k.

In the absence of the policy, the supply curve of the competitive firm is upward-sloping. The nonlinearity of the subsidy schedule changes the profit function of the competitive firm to a linear function:

$$(26)\quad \pi(x) = px + x\{a-k+1/2\ bx\} - ax - 1/2\ bx^2$$
$$= (p-k)x.$$

The schedule that accomplishes this goal can be thought of as a "forgivable tax" per unit. The exporter pays (k-a) on the first unit sold. If he sells more, his per-unit tax falls. Eventually, the per-unit tax would become a per-unit subsidy, which would increase as more units were exported. If the exporter contemplates selling another unit at a given price, he must take into account not only the increase in production cost ($c'(x) = a + bx$) but also the decrease in tax payments ($a-k + bx$). The net increase in cost is k, regardless of the volume. Suppose that the government of the exporting country sought to restore the competitive outcome ($k=p_c$). The subsidy payments or tax receipts required to implement such a policy are easy to calculate. Under competition, the amount exported is defined as follows:

$$(27) \quad p_c = c'(x) = a + bx$$

$$\Rightarrow x = \frac{p_c - a}{b}.$$

A tax/subsidy schedule of $s(x) = (a-p_c) + 1/2\ bx$ will restore the competitive outcome. Substituting, we obtain

$$(28) \quad s(x) = (a-p_c) + \frac{1}{2}b\left(\frac{p_c-a}{b}\right) = \frac{1}{2}(a-p_c) < 0.$$

Hence, the government would collect tax revenue in the process of restoring the competitive outcome. Figure 3 depicts the tax/subsidy schedule under discussion and the per-unit tax that arises in equilibrium.

The preceding example is interesting if (and only if) the principles implicit in it apply more generally. Suppose that the supply curve of the competitive firm is not linear. Can a tax/subsidy schedule still be devised to neutralize the monopsony power of the importer? If so, what form will it take? In equilibrium how much will it cost or benefit the government to implement the policy, and how will the gains

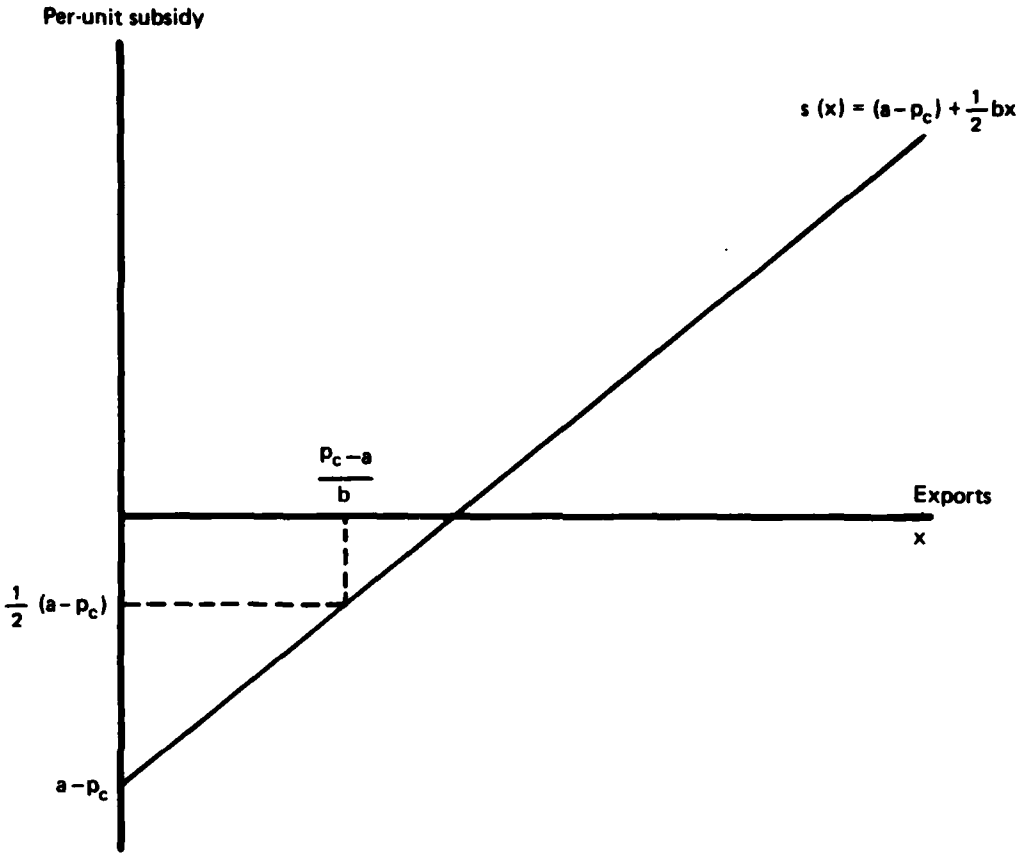

Fig. 3 — Tax/subsidy schedule for seller that achieves competitive outcome

from restoring an efficient outcome be distributed? These questions are addressed in turn.

For any total cost curve (c(x)) of the firm, the government can design a total subsidy schedule (S(x) = x s(x)) such that the competitive firm will have perfectly elastic supply at price k. The appropriate schedule has the following form:

(29) $S(x) = c(x) - kx.$

Proof: since the firm's total profits are

(30) $\pi(x) = px - [c(x) - S(x)]$

$= px - [c(x) + kx - c(x)] = (p-k)x,$

the firm's output will be perfectly elastic at price k.

If the government sets $k=p_c$ so as to restore the competitive outcome, then the firm receives $S(x_c)$ from the government, where x_c solves $p_c=c'(x_c)$. Since $S(x_c) = c(x_c) - p_c x_c<0$, the government policy induces the firm to pay in taxes precisely what it would earn as producer surplus under competition in the absence of monopsony power by the buyer. In other words, the policy restores competition and simultaneously extracts the surplus that the firm would otherwise have earned.

By implementing the tax-subsidy schedule, the government of the exporting firm changes an inefficient, monopsonistic allocation to an efficient, competitive allocation. The welfare effects are the reverse of those discussed earlier. The importer loses because his monopsony power is neutralized. And the *sum* of treasury revenues and firm profits in the exporting country increases. The firm earns zero profits but could be given a rebate from the government. To preserve efficiency such a rebate should be unrelated to the firm's export decisions.

Suppose that the government imposed the tax schedule on the *importer* instead of the firm. Contrary to what rote learning in Economics Principles courses might lead one to expect, it is not irrelevant whether the buyer or the seller is faced with the tax/subsidy schedule. The monopsonist would select the level of imports to

$$(31)\quad \underset{x \geq 0}{\text{maximize}} \int_0^x p(u)du - px - [kx - c(x)]$$

$$\text{subject to } p = c'(x)$$

and would set x to solve $p(x) - c'(x) - xc''(x) + c'(x) - k = 0$

$$= p(x) - xc''(x) - k = 0.$$

Clearly, this tax/subsidy schedule does not give the monopsonist an incentive to import the competitive volume x_c, although that volume would be exported if the seller were faced with the same schedule. The intuition underlying this result is straightforward. The marginal cost of the tax would be the same whether it was imposed on the buyer or on the seller. But since the before-tax marginal benefits to the importer or to the exporter of making a particular quantity decision differ, the two sides of the market would react to the tax schedule differently.

Is there some other nonlinear tax/subsidy schedule which could be imposed on the monopsonist to restore the competitive outcome? Let T(x) be that tax schedule. The monopsonist would seek to

$$(32)\quad \underset{x \geq 0}{\text{maximize}} \int_0^x p(u)du - px - T(x)$$

$$\text{subject to } p = c'(x)$$

by setting $p(x) - xc''(x) - c'(x) - T'(x) = 0$.

If $-xc''(x) - T'(x) = 0$ for all x, the competitive volume of imports would be chosen. Any tax of the following form would suffice:

$$(33)\quad T(x) = T(0) - \int_0^x uc''(u)du.$$

In the earlier illustration, for example, $c'(x) = a + bx$ and hence

$$(34)\quad T(x) = T(0) - \int_0^x ubdu = T(0) - \frac{bx^2}{2}.$$

The government of the exporting country is free to set T(0) at whatever value is desired. If it wishes to maximize its advantage, it should set T(0) so that the importing consumer enjoys no surplus whatsoever:

$$(35)\quad \int_0^{x_c} p(u)du - p_c x_c - \{T(0) - \int_0^{x_c} uc''(u)du\} = 0$$

$$\Rightarrow\quad T(0) = \int_0^{x_c} \{p(u) + uc''(u)\}\, du - p_c x_c.$$

A tax schedule with these characteristics neutralizes the monopsony power of the importer, restores the competitive price, output, and profit of the firm, and extracts the *entire* consumer surplus that the buyer would enjoy under competition.

IV. AN ILLUSTRATION OF THE FOREIGN-POLICY CONSEQUENCES OF EXPORT SUBSIDIES

Even if a subsidy on exports cannot be justified on purely economic grounds, such a policy may occasionally have beneficial foreign-policy consequences of overriding importance. In what follows, the Soviet Union is assumed to require oil to produce output. The output produced can be used for military or nonmilitary purposes. The Soviets can acquire oil inputs by (1) drilling at home, (2) purchasing oil from the world market, and (3) exerting military pressure on the Persian Gulf states. Sole reliance on any one of these sources would be unduly expensive. Hence, the Soviets find that the cheapest way to acquire any given amount of oil is a balanced exploitation of each of these three sources of supply. Since some of the output produced must be used to cover the costs of acquiring it, the Soviets are assumed to maximize the amount of output produced net of the costs of acquisition. Such an objective is in their self-interest no matter how they intend to allocate the resulting net output.

Let Q_D, Q_W, and Q_M denote crude oil acquired, respectively, from drilling at home, purchasing abroad, or military expansion. Let $C_D(Q_D;X)$, $C_W(Q_W)$, and $C(Q_M)$ denote the total cost in terms of output of pursuing each activity at the rate indicated. (X denotes a policy parameter of the United States and is discussed below.) Let $G(Z)$ be the gross output that the Soviets can produce from Z units of crude. Then to maximize the net output available for military or nonmilitary purposes the Soviets will

$$(36)\quad \underset{Q_M,\ Q_W,\ Q_D \geq 0}{\text{Maximize}} \quad G(Q_D + Q_W + Q_M) - C_M(Q_M) - C_W(Q_W) - C_D(Q_D;\ X).$$

If the optimal strategy involves some acquisition from each source, then the common marginal cost of acquisition should be equated to the additional production that would be induced by additional acquisition:

$$(37)\quad G'(Q_D + Q_W + Q_M) = C'(Q_M) = C_W'(Q_W) = C_D'(Q_D;\ X).$$

The maximized net output that results, $G(Q_D + Q_W + Q_M)$, can be used for military or nonmilitary purposes according to the preferences of the Soviet leadership. Figure 4 illustrates the best allocation of the output produced given preferences about military and nonmilitary spending.

Assume that initially the Soviets import K_0 units of oil-drilling equipment from the United States at price P_0. Assume that the same equipment is available from other sources at price $P>P_0$. Whether the United States prohibits its firms from exporting such equipment or, alternatively, encourages its export by means of export subsidies will affect Soviet behavior.[1] Any trade policy will in principle affect (1) the amount of crude oil the Soviets choose to obtain from each source, (2) the net output produced, and (3) the allocation of the resulting output between military and nonmilitary uses. An embargo of drilling equipment, for example, will reduce the net output available for either use, but will raise the marginal cost of drilling at home and will encourage the Soviets to acquire more oil on the world market or through military expansion. An export *subsidy*, on the other hand, will reduce the marginal cost of acquiring oil at home and will therefore *reduce* military pressure on countries in the Persian Gulf. The substitution of domestic drilling activity for military pressure on the Gulf States is assumed to be something the United States wishes to encourage. However, the "income effects" of such a subsidy may be undesirable, because the resulting increase in production may help finance an increased military

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[1] This example is not, of course, unrealistic. The Soviet Union continues to face the prospect of declining supplies from its major oil fields. Several years ago, it embarked upon a crash program to develop new oil and gas fields in Western Siberia. Bedeviled by antiquated drilling and exploration technology, the Soviets launched a program of massive imports of equipment unavailable at home: control gauges, seismic recording devices, rigs, blow-out monitors, well-head equipment, drilling bits, and so forth. Although the Soviets placed orders for some of this equipment with Japan, Italy, West Germany, France, Sweden, Norway and England, it was to the United States that they principally turned. For a discussion of the ongoing Soviet energy crisis and the debate it triggered within the Carter Administration's National Security Council, see the twin articles by Herbert Meyer [*Fortune Magazine*, January 29, 1979 and February 25, 1980].

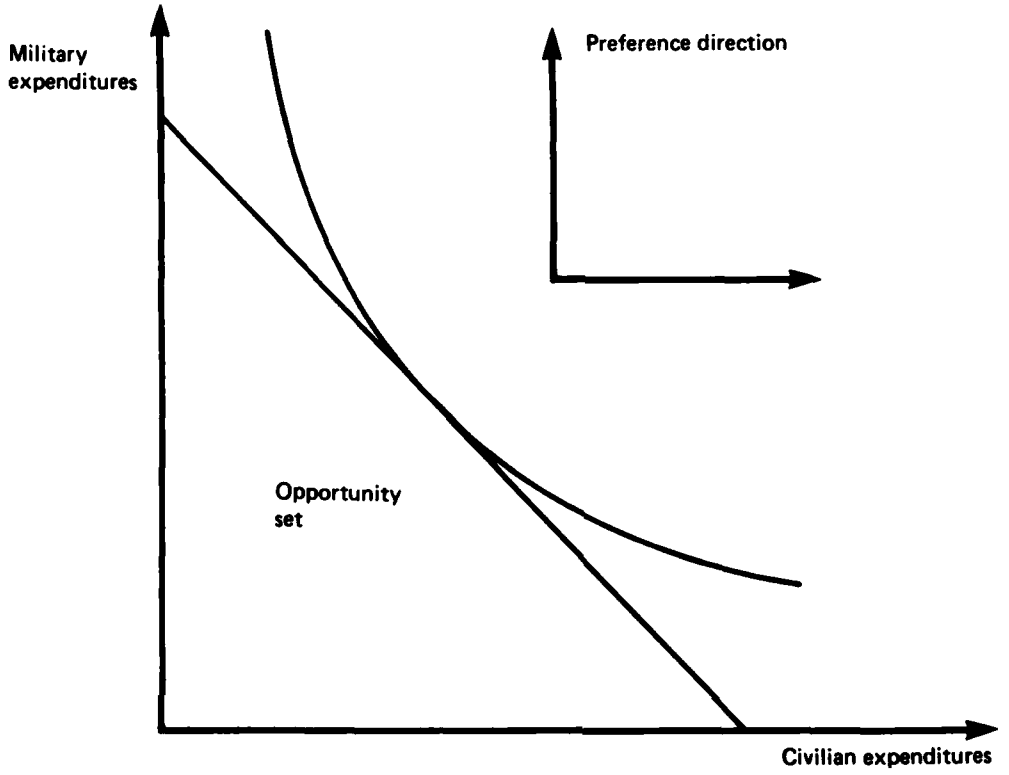

Fig. 4 – Optimal allocation of net output between military and non-military uses

buildup.

A more sophisticated trade policy, however, can encourage the Soviets to drill more at home *without* financing increased military spending. Consider the following policy. Suppose that the United States government *subsidized* the export of drilling equipment to the Soviet Union but charged the Soviets a substantial amount for access to the U.S. market. By setting the access fee high, the United States could increase the cost of importing the same amount of equipment as before to its previous level (or higher); but by subsidizing Soviet imports of equipment, the United States could reduce the marginal cost of importing additional equipment and could make further development of domestic fields *attractive at the margin* relative to the alternatives the United States wishes to discourage. The prospect that the Soviets will buy their equipment from another source is included in the example to show that the existence of such alternatives constrains but does not eliminate United States leverage.

A typical "two-part subsidy" is illustrated in Fig. 5, which depicts three linear schedules. The flatter ray through the origin indicates the cost of acquiring various amounts of equipment from the United States in the absence of intervention. The steeper ray indicates the cost of acquiring equipment from the alternative source--which would be the best available source in the event of a United States embargo. The third schedule has vertical intercept E and slope P_0-S, where $S\varepsilon(0, P_0)$ is a per-unit subsidy and E is an access charge.

Faced with the opportunity to buy from the alternative source at price P or--after paying the access fee--from the United States at price P_0-S per unit, the Soviets would presumably make their purchase of equipment at least cost. In the diagram, E has been set so that, for acquisitions of less than K_0 units, it is cheaper to buy everything from the alternative source; for larger acquisitions, importing all the equipment from the United States is cheaper. The cost of acquiring K units of equipment in the cheapest way is simply the lower envelope of the schedules with slopes P and P_0-S. Given the particular access charge in Fig. 5, acquiring as much equipment as before is more costly by $E-SK_0$.[2] Further acquisitions of equipment for domestic drilling, however, are cheaper

[2]If the subsidy is constant, some level of import will exist above

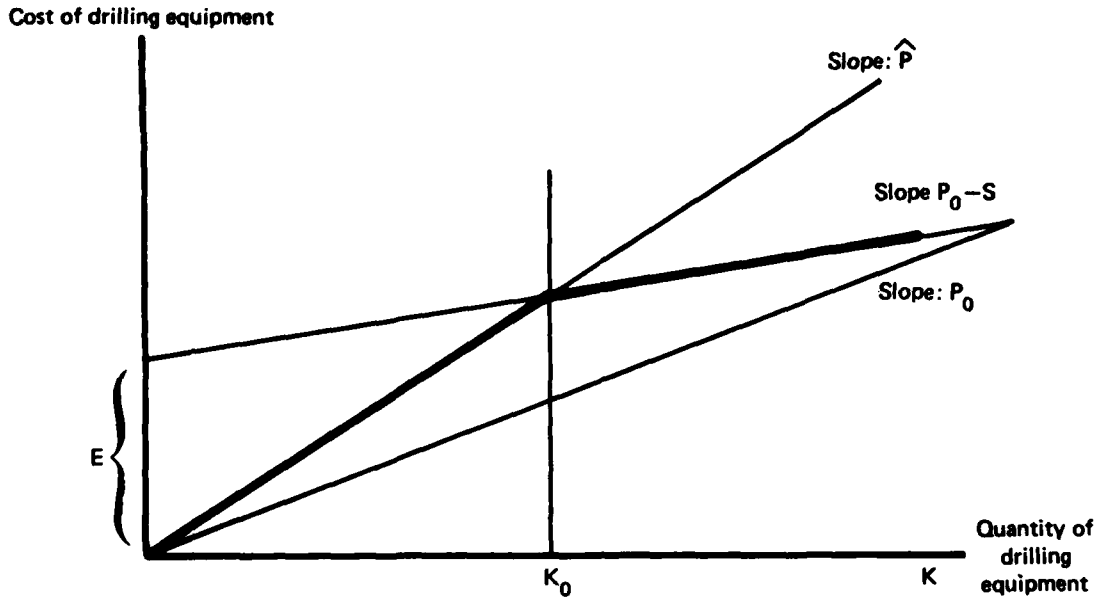

Fig. 5 – Access-fee-cum-subsidy on drilling equipment

than they were previously. Thus, the Soviets are encouraged to exploit their domestic supplies rather than to invade still another country or to drive up prices further on the world oil market. The effect of the export policy on their oil acquisition decisions is depicted in Fig. 6. The far left-hand panel shows the derivative of the aggregate production function plotted against the sum of the inputs from the three sources. Each of the three remaining panels depicts the marginal cost of acquiring oil from a particular source. The panel on the far right depicts the marginal-cost curve of domestic oil *extraction*--the curve of primary interest.[3] Initially, the Soviets set the marginal product of increased crude use equal to the marginal cost of increased crude acquisition from each source.

Imposition of an access-fee-cum-subsidy shifts the marginal cost of domestic extraction and displaces the equilibrium. If an access fee is chosen so that the Soviets would just be indifferent between the two suppliers of equipment at the old level of purchases (K_0), the marginal cost curve will shift upward everywhere by the factor P/P_0 to the left of the old extraction level and will shift downward everywhere by the factor $(P_0-S)/P_0$ to the right of this level.

Imposition of the two-part subsidy will simultaneously reduce Soviet purchases from the world market and discourage acquisition of supplies by military expansion. It will increase Soviet reliance on U.S. exports of drilling equipment. But, as illustrated in Fig. 6, such a policy can reduce Soviet net output (after payment of the access fee). Graphically, the "budget line" in Fig. 4 will shift inward. Hence the policy is unlikely to contribute to a military buildup. From the U.S. viewpoint, this export policy curbs Soviet expansionism and may indeed have no economic cost. The access fee charged to Soviets is more than enough to cover the per-unit subsidies paid. Whether the excess is sufficient to cover the deadweight loss that results because the firms

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which the saving from the subsidy *exceeds* the cost of the access This raises the prospect that the Soviets could buy United States equipment at subsidized rates and could resell it at a profit. For this reason, it is recommended that the subsidy be removed for imports exceeding a specified level.

[3] It is assumed that domestic crude oil can be pumped at increased rates only by using more oil-drilling equipment.

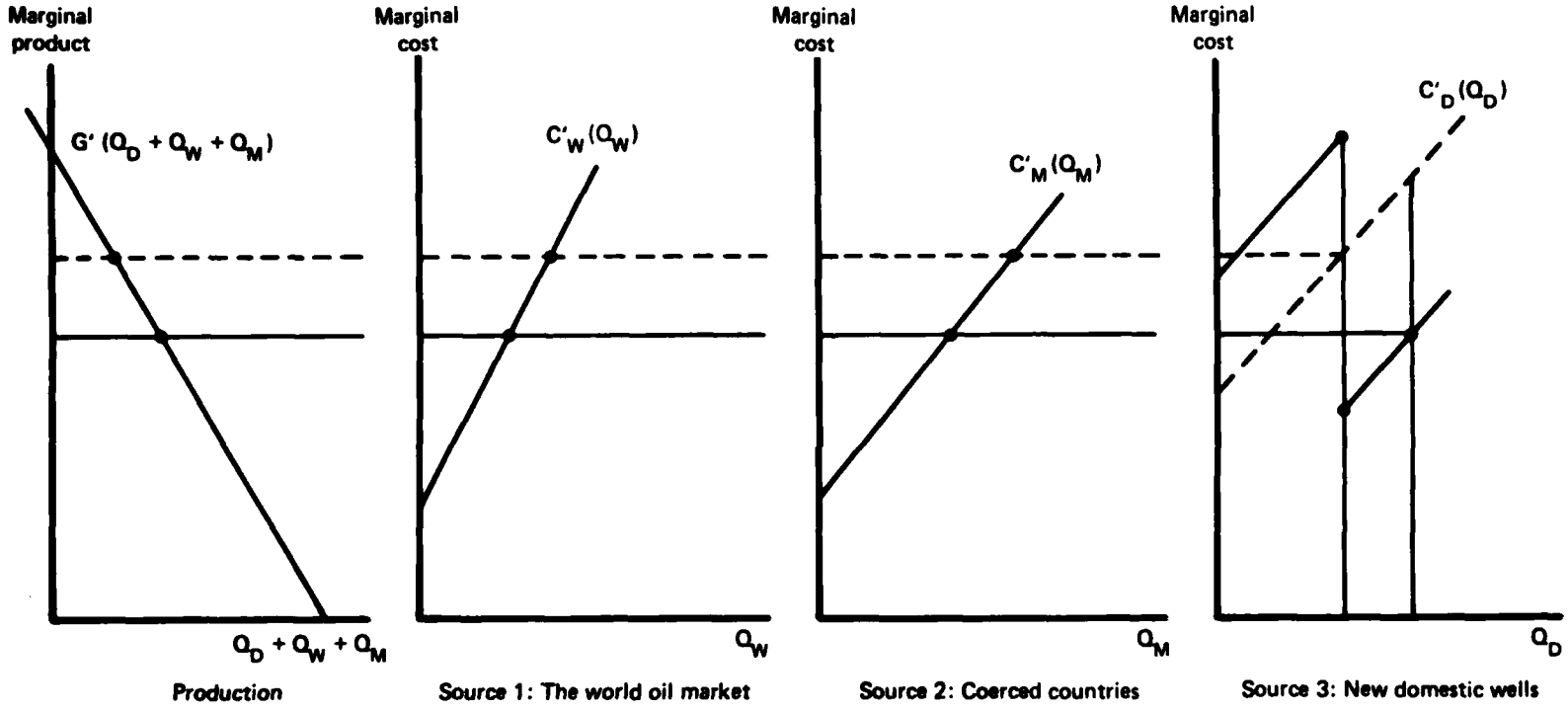

Fig. 6 – The access-fee-cum-subsidy displacing the old equilibrium (dashed lines) by shifting the domestic marginal cost curve and making it discontinuous

exporting drilling equipment produce more than the efficient level of output is ambiguous. But even if a small economic cost were involved, it might well be outweighed by the foreign policy benefits that the policy provides.

A variety of policies exists with similar consequences. Because in the market considered here both the Soviet importers of U.S. equipment and the U.S. export firms are competitive, it is irrelevant who receives the subsidy. Hence, the United States could pay the subsidy to its own firms for each unit of equipment exported and could require that the Soviets pay a fee for access to U.S. markets. Alternatively, the access fee could be spread in a variety of ways over the *inframarginal* units and relabeled a tariff. As long as the *marginal* purchases are subsidized by an unchanged amount per unit and as long as the total payments by the Soviets do not change, all such policies would be equivalent.

V. CONCLUSIONS

I have investigated a number of arguments that are often advanced to justify export subsidies. Such export subsidies may indeed increase an exporting country's welfare under certain conditions. If the importers lack market power, cases where an export subsidy promotes the general economic interest can always be identified from the following thought experiment. Suppose that the domestic economy were taken over entirely by a monopolist. If there are foreign firms in the example, assume that this monopolist takes the *reactions* of the foreign firms fully into account.[1] Compare the exports chosen by this monopolist with the exports in the prior situation. If any export firm would be directed by the monopolist to expand its production, then in the decentralized market solution it would be optimal for that export firm to receive a government subsidy. In the interfirm learning case, for example, the monopolist would find that expanding the exports of the first firm would work to his advantage and would internalize this externality. In the complements case, he would find that expanding the production of good x would drive up the price of good y and would increase his overall profits. In Brander-Spencer's example, the monopolist would find only one domestic firm to take over; but since the monopolist is assumed to take the *reaction* of the foreign firm into account, he would find that expanding its production and causing the foreign firm to contract would increase his profits.[2] If he took over a domestic economy with several firms, however, he would want to reduce output to increase his profits.

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[1]Such a monopolist is sometimes referred to as a Stackelberg leader.

[2]A thorough, industry-by-industry study of the current export promotion policies of the OECD countries, and of whether this support could be justified by one of the economic arguments discussed in this paper, has to the best of my knowledge not been undertaken. On the sketchy evidence available, however, the applicability of these arguments to many export subsidization decisions seems open to question.

If the buyer is a monopsonist, however, the proposed thought experiment is no longer helpful. I examined the case where competitive exporters all reside in a *single* country. I found that if the government of that country acts optimally it can neutralize the monopsonist's power and extract all his surplus with a nonlinear tax schedule. The next step in this analysis would be a generalization to the case where the exporting firms are located in *different* countries and face a monopsonist. Finally, there is the matter of the trade policies that the governments of these countries would select if they behaved noncooperatively, and the possibility of inducing cooperation among the Western governments.

For the specific case of trade with the Soviet Union, export taxes and subsidies also show promise as instruments of foreign policy. Such policies can promote Soviet behavior that lies in the foreign policy interests of the United States. In the example analyzed, a subsidy on marginal units of drilling equipment imported encourages domestic drilling and curbs Soviet pressure on the Persian Gulf States, while an access fee or tax on inframarginal units imported prevents the subsidies from contributing to a Soviet military buildup. I can only indicate this possibility here and illustrate the principle involved with examples. But with better information about the opportunities that the Soviet Union faces, it might be possible to turn U.S. trade policy into an effective foreign policy tool.

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